SANYO

Service Manual

Biomedical freezer

MDF-136
MDF-236
MDF-436

SANYO Electric Biomedical Co., Ltd

MDF-236

SM7210138

Effective models

This service manual is effective following models.

Model name	Model code	Voltage and Frequency
MDF-236	823 165 51	115V 60Hz
	823 165 52	220V 50Hz
	823 165 53	
	823 165 54	230V 50Hz
	823 165 55	240V 50Hz
	823 165 56	230V 50Hz
	823 165 57	220V 50Hz
	823 165 58	110V 60Hz
	823 165 59	220V 50Hz
	823 165 60	240V 50Hz
	823 165 61	
	823 165 62	
MDF-136	823 166 51	115V 60Hz
	823 166 52	220V 50Hz
	823 166 53	220V 60Hz
	823 166 54	230V 50Hz
	823 166 55	240V 50Hz
	823 166 56	220V 50Hz
	823 166 57	110V 60Hz
	823 166 58	230V 50Hz
	823 166 59	220V 50Hz
	823 169 60	240V 50Hz
	823 166 61	
	823 166 62	
MDF-436	823 167 51	115V 60Hz
	823 167 52	220V 50Hz
	823 167 53	220V 60Hz
	823 167 54	230V 50Hz
	823 167 55	240V 50Hz
	823 167 56	240V 50Hz
	823 167 57	230V 50Hz
	823 167 58	110V 60Hz
	823 167 59	220V 50Hz
	823 167 60	220V 50Hz
	823 167 61	
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Features

■ HFC refrigerant
Refrigerant circuit contains HFC refrigerant that effect to environment little.
Latest cooling system reduces negative factor to global environment. With ambient temperature shown at 35℃, while temperature inside chamber maintains -35℃.

■ PCM structure
PCM structure reduces amount of organic solvent.

■ Easy operation
Balance hinge have better safety and operation on door opening/closing.
Display panel and keypad settled in upper part of unit, which makes operation easily.

■ Specification unified
Unified specification for same categories, which also unify performance for high/low temperature alarm (SV is changeable in the range ±5～±15℃), power failure alarm, remote alarm terminal, setting memorization by non-volatile memory.

■ Self diagnosis function
Abnormal condition for temperature sensor is indicated by self-diagnosis system.

■ Validation
Control panel enables zero “0” adjust for validation.

■ Various function mode

Specification

MDF-136

Items		Specification
Model description		Biomedical freezer
Model Number		MDF-136
Outer dimension (Max)		W 640 × D 687 × H 881 mm
Inner dimension		W 525 × D 440 × H 715 mm
Effective chamber capacity		138 lit.
Cooling performance		-35℃ at 1/2 height of the chamber（AT：35℃、No load）
Exterior		Zinc galvanized steel w/powder polyester coating (new bio-gray)
Interior		Colored aluminum steel
Insulation		Rigid polyurethane foam … Insulation: RU-1050 Foam: R-142b/R-22
Outer door		Zinc galvanized steel w/powder polyester coating (new bio-gray)
Hinge		Balance hinge（2 pcs） CWVS3300 1 pc, CMVS3345 1 pc
Door lock		1 pc (Action stroke: 10mm)
Accessories	Basket	Hard steel wire PE coating
		2 pcs (Max: 5 pcs)
	Plate	2 pcs
	Others	Defrosting spatula 1 pc, card holder 1 pc, key 1 set
Caster		4 pcs. (Front & rear movement wheels)
Leveling legs		2 pcs in front side.
Access hole		ϕ17mm. 1 places in right side of access hole and 2 in left side of bottom of recorder sensor access hole.
Option		Chart recorder: MTR-4014LH,MTR-G85 Basket: MDF-13B2 (2 pcs) :MDF-13B3（3 pcs）
Weights		45 Kg

Items		Specification
Internal temp. control range		-20℃～-35℃ （AT：-5℃～35℃、No load）
Temperature controller		Microprocessor controlled system with non-volatilized memory. Temp. set range : -18℃～-40℃
Temperature sensor		Thermistor
Temperature display		LED digital display (green colored) by 1℃. Range : -50℃～50℃
Alarm	High/Low Temperature	Changeable SV±5℃～15℃. (Initial SV±10℃) ALARM lamp brinks and buzzer sounds intermittently (about 15 min. delay) Remote alarm contact: turns ON with buzzer sounds
	Power failure	ALARM lamp brinks, buzzer sounds intermittently, remote alarm contact turns ON
	Remote	Remote alarm terminal 2P: contact capacity DC30v, 2A, N.O. – COM. (During temperature alarm, power failure alarm, alarm test: ON)
Control panel		ALARM lamp BUZZER: Buzzer key ALARM TEST: Alarm test key SET: To switch the SV and PV ＞: To shift the set digit ∧: To change the SV DEF: Defrost key Battery switch: Power switch for power failure alarm
Key lock function		Press ＞ key for five seconds L0: Unlock　L1: Lock
Self diagnosis function		When temperature sensor is in fault, Error code (E1/E2) and internal temperature are displayed alternately. Remote alarm contact turns ON with buzzer sounds. When buttery switch OFF check is in fault, (available during alarm test), Error code (E09) and internal temperature are displayed alternately.
Power switch		Side on rear box
Battery switch		Side on rear box
Power supply		Local voltage

Specification

MDF-236

Items		Specification
Model description		Biomedical freezer
Model Number		MDF-236
Outer dimension (Max)		W 905 × D 687 × H 881 mm
Inner dimension		W 790 × D 440 × H 715 mm
Effective chamber capacity		221 lit.
Cooling performance		-35℃ at 1/2 height of the chamber（AT：35℃、No load）
Exterior		Zinc galvanized steel w/powder polyester coating
Interior		Colored aluminum steel
Insulation		Rigid polyurethane foam … Insulation: RU-1050 Foam: R-142b/R-22
Outer door		Zinc galvanized steel w/acrylic resin print coating
Hinge		Balance hinge（2 pcs） CMVS3342
Door lock		1 pc (10mm for action stroke)
Accessories	Basket	Hard steel wire PE coating
		3 pcs (max: 8pcs)
	Plate	3 pcs
	Others	Defrosting spatula 1 pc, card holder 1 pc, key 1 set
Caster		4 pcs. (Front & rear movement wheels)
Leveling legs		2 pcs in front side.
Access hole		ϕ17mm. 1 places in right side of access hole and 2 in left side of bottom of recorder sensor access hole.
Option		Chart recorder : MTR-4014LH,MTR-G85 Basket : MDF-13B2 (2 pcs) :MDF-13B3（3 pcs）
Weights		54 Kg

Items		Specification
Internal temp. control range		-20℃～-35℃ （AT：-5℃～35℃、No load）
Temperature controller		Microprocessor controlled system with non-volatilized memory. Temp. set range : -18℃～-40℃
Temperature sensor		Thermistor
Temperature display		LED digital display (green colored) by 1℃. Range : -50℃～50℃
Alarm	High/Low Temperature	Changeable SV±5℃～15℃. (Initial SV±10℃) ALARM lamp brinks and buzzer sounds intermittently (about 15 min. delay) Remote alarm contact: turns ON with buzzer sounds
	Power failure	ALARM lamp brinks, buzzer sounds intermittently, remote alarm contact turns ON.
	Remote	Remote alarm terminal 2P: contact capacity DC30V, 2A, N.O. – COM. (During temperature alarm, power failure alarm, alarm test: turns ON)
Control panel		ALARM lamp BUZZER: Buzzer key ALARM TEST: Alarm test key SET: To switch the SV and PV ＞: To shift the set digit ∧: To change the SV DEF: Defrost key Battery switch: Power switch for power failure alarm
Key lock function		Press ＞ key for five seconds L0: Unlock　L1: Lock
Self diagnosis function		When temperature sensor is in fault, Error code (E1/E2) and internal temperature are displayed alternately. Remote alarm contact turns ON with buzzer sounds. When buttery switch OFF check is in fault, (available during alarm test) Error code (E09) and internal temperature are displayed alternately.
Power switch		Side on rear box
Battery switch		Side on rear box
Power supply		Local voltage

Specification

MDF-436

Items		Specification
Model description		Biomedical freezer
Model Number		MDF-436
Outer dimension (Max)		W 1265 × D 807 × H 905 mm
Inner dimension		W 1140 × D 550 × H 735 mm
Effective chamber capacity		426 lit.
Cooling performance		-35℃ at 1/2 height of the chamber（AT：35℃、No load）
Exterior		Zinc galvanized steel w/powder polyester coating (New bio-gray)
Interior		Colored aluminum steel
Insulation		Rigid polyurethane foam … Insulation: RU-1050 Foam: R-142b/R-22
Outer door		Zinc galvanized steel w/powder polyester coating (New bio-gray)
Hinge		Balance hinge（2 pcs） CWVS3346 (1 pc) CMVS3348 (1 pc)
Door lock		1 pc (Action stroke: 10mm)
Accessories	Basket	Hard steel wire PE coating
		4 pcs (max: 11 pcs)
	Plate	4 pcs
	Others	Defrosting spatula 1 pc, card holder 1 pc, key 1 set
Caster		4 pcs. (Front & rear movement wheels)
Leveling legs		2 pcs in front side.
Access hole		ϕ17mm. 1 places in right side of access hole and 2 in left side of bottom of recorder sensor access hole.
Option		Chart recorder: MTR-4014LH,MTR-G85 Basket: MDF-43B2 (2 pcs) : MDF-43B3（3 pcs）
Weights		71 Kg

Items		Specification
Internal temp. control range		-20℃～-35℃ (AT:-5℃～35℃、No load)
Temperature controller		Microprocessor controlled system with non-volatilized memory. Temp. set range : -18℃～-40℃
Temperature sensor		Thermistor
Temperature display		LED digital display by 1℃. Range : -50℃～50℃
Alarm	High/Low Temperature	Changeable SV±5℃～15℃. (Initial SV±10℃) ALARM lamp brinks and buzzer sounds intermittently (about 15 min. delay) Remote alarm contact: turns ON with buzzer sounds
	Power failure	ALARM lamp brinks, buzzer sounds intermittently, remote alarm contact turns ON.
	Remote	Remote alarm terminal 2P: contact capacity DC30V, 2A, N.O. – COM. (During temperature alarm, power failure alarm, alarm test: turns ON)
Control panel		ALARM lamp BUZZER: Buzzer key ALARM TEST: Alarm test key SET: To switch the SV and PV ＞: To shift the set digit ∧: To change the SV DEF: Defrost key Battery switch: Power switch for power failure alarm
Key lock function		Press ＞ key for five seconds L0: Unlock L1: Lock
Self diagnosis function		When temperature sensor is in fault, Error code (E01/E02) and internal temperature are displayed alternately. When compressor protect sensor is in fault, Error code (E03/E04) and internal temperature are displayed alternately. When temperature of compressor abnormally rises, Error code (E10) and internal temperature are displayed alternately. When buttery switch OFF check is in fault (available during alarm test), Error code (E09) and internal temperature are displayed alternately.
Power switch		Side on rear box
Battery switch		Side on rear box
Power supply		Local voltage

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Specification of electrical parts

MDF- 136 / 236		AC110-115V,60Hz	AC220-240V , 50/60Hz
Compressor	Type	C-2SN170L0S	C-2SN170L6S
	Code	807675201	807675261
	Rated voltage (50/60Hz)	100 / 100 - 115	220,240 / 220
	Winding resistance C-S(Aux)	7.5Ω	35.4Ω
	C-R(Main)	2.9Ω	11.3Ω
Starting relay	Type	AMVL-165	AMVL-300A
	Pick up voltage(50Hz)	AC79V～99V	AC185V～217V
	(60Hz)	AC95～115V	AC215～232V
	Drop out voltage(50Hz)	AC20～55V	AC60～120V
	(60Hz)	AC25～60V	AC69～132V
Overload relay	Type	P15KU	P80KU
	Action to the temp. (No current)		
	OFF	150±10℃	150±8℃
	ON	85±10℃	85±10℃
	Action to the current (AT25℃)	15.5A	8A
	Operation time	6～15 seconds	6～15 seconds
	Non-Action to the temp. (80℃)		
	Non-Action	3.8A more than 30 minutes	2.35A more than 30 minutes
	Action	5.1A within 15 minutes	3.1A within 15 minutes
Starting capacitor	Rating	100μF,160VAC	20μF,300VAC
Running capacitor	Rating	16μF,220VAC	5μF,400VAC
Power relay	Type	G4F-11123T	G4F-11123T
	Contact capacity	AC220V,20A	AC220V,20A
	Coil	DC12V	DC12V
Switching power supply	Type	ZWS10-12/J	ZWS10-12/J
	Input	AC100-240V,50/60Hz,0.3A	AC100-240V,50/60Hz,0.3A
	Rated output	DC12V,0.85A	DC12V,0.85A
Temperature sensor	Type	502AT-1	502AT-1
	Rating	5kΩ,25℃	5kΩ,25℃
P.C.B.	Type	DF-236	DF-236
Battery	Type	5HR-AAC(Ni-MH)	5HR-AAC(Ni-MH)
	Rating	6V 1100mAH	6V 1100mAH
Battery switch	Type	SLE6A2-5	SLE6A2-5
	Rating	AC250V 4A	AC250V 4A
Breaker switch	Type	BAM215131	BAM215131
	Rating	AC250V 15A	AC250V 15A

Specification of electrical parts

MDF- 436		AC110-115V,60Hz	AC220-240V , 50/60Hz
Compressor	Type	C-2SN350I 0R	C-2SN350I 5S
	Code	807764201	807763251
	Rated voltage (50/60Hz)	ーー ／ 110-115V	220-240V ／ 220V
	Winding resistance C-S(Aux)	5.8Ω	30.6Ω
	C-R(Main)	1.6Ω	7.8Ω
Starting relay	Type	AMVL-180A	AMVL-300A
	Pick up voltage(50Hz)	AC91V～111V	AC185V～217V
	(60Hz)	AC108～128V	AC215～232V
	Drop out voltage(50Hz)	AC30～65V	AC60～120V
	(60Hz)	AC30～75V	AC69～132V
Overload relay	Type	P24KU	P10MU
	Action to the temp. (No current)		
	OFF	150±10℃	130±8℃
	ON	85±10℃	69±10℃
	Action to the current (AT25℃)	24.0A	10A
	Operation time	6～15 seconds	6～15 seconds
	Non-Action to the temp. (80℃)		
	Non-Action	6.1A more than 30 minutes	2.5A more than 30 minutes
	Action	8.0A within 15 minutes	3.4A within 15 minutes
Starting capacitor	Rating	100μF,160VAC	30μF,300VAC
Running capacitor	Rating	25μF,220VAC	5μF,400VAC
Power relay	Type	G4F-11123T	G4F-11123T
	Contact capacity	AC220V,20A	AC220V,20A
	Coil	DC12V	DC12V
Switching power supply	Type	ZWS10-12/J	ZWS10-12/J
	Input	AC100-240V,50/60Hz,0.3A	AC100-240V,50/60Hz,0.3A
	Rated output	DC12V,0.85A	DC12V,0.85A
Temperature sensor	Type	502AT-1	502AT-1
	Rating	5kΩ,25℃	5kΩ,25℃
Compressor protect sensor	Type	502AT-1	502AT-1
	Rating	5kΩ,25℃	5kΩ,25℃
P.C.B.	Type	DF-436	DF-436
Battery	Type	5HR-AAC(Ni-MH)	5HR-AAC(Ni-MH)
	Rating	6V 1100mAH	6V 1100mAH
Battery switch	Type	SLE6A2-5	SLE6A2-5
	Rating	AC250V 4A	AC250V 4A
Breaker switch	Type	BAM215131	BAM215131
	Rating	AC250V 15A	AC250V 15A
Condensing fan motor	Type	FL2-C021R1MP	FL2-C021R5MP
	Rating	AC110-115V 50/60Hz	220-240V 50/60Hz
	Thermal fuse	130℃	130℃

Specifications of sensor

The following show temperature and resistance characteristics on each thermistor sensor (type 502).

Temperature (℃)	Resistance (kΩ)	Temperature (℃)	Resistance (kΩ)	Temperature (℃)	Resistance (kΩ)
−50	154.50	−7	17.92	12	8.17
−45	116.50	−6	17.16	13	7.85
−40	88.85	−5	16.43	14	7.55
−35	68.15	−4	15.74	15	7.27
−30	52.84	−3	15.08	16	6.99
−25	41.19	−2	14.45	17	6.73
−20	32.43	−1	13.86	18	6.48
−19	30.92	0	13.29	19	6.24
−18	29.50	1	12.74	20	6.01
−17	28.14	2	12.22	25	5.00
−16	26.87	3	11.72	30	4.18
−15	25.65	4	11.25	35	3.51
−14	24.51	5	10.80	40	2.96
−13	23.42	6	10.37	45	2.51
−12	22.39	7	9.96	50	2.14
−11	21.41	8	9.57	55	1.83
−10	20.48	9	9.20	60	1.57
−9	19.58	10	8.84		
−8	18.73	11	8.49		

Control specification

<MDF-136·236·436>

1. Key and switch

BZ : When alarm lamp is blinking and buzzer sounds, buzzer and remote alarm Output ..... Force to turn off
: Buzzer is not turned off during alarm test.
: When alarm lamp is blinking and buzzer is off, buzzer will not turn on.
: When press this key during power failure, current temperature is displayed for 5 seconds.

SET : Press once to setting mode and press again to memorize the set value. (It works as ENTER key)

DEF : In PV display keep pressing the key over 5 seconds to start defrosting.
During defrosting, press the key to quit defrosting.
During defrosting, internal temperature and "dF" is displayed Alternately.
During defrosting, high-low temperature alarm is cancelled.
When sensor error is occurred during defrosting, error code and internal temperature is displayed alternately, and "dF" display is turned off.
During defrosting, only buzzer key is acceptable.

ALARM TEST : Keep pressing the key over than 5 seconds in PV display, it will be start alarm test.
Press again then quit alarm test.
During alarm test, alarm lamp will blink ,buzzer will sound intermittently and remote alarm contact will turn on.
Digital display will be turned off.
During alarm test, only alarm test key is acceptable.

▶▶ : During setting mode, shift between the first digit and the second digit.
In PV display, keep pressing the key over 5 seconds to enter the key lock mode. ("L0" display)

⏫ : During setting mode, count up the blinking digit. In PV display, keep pressing the key over 5 seconds to enter the function mode ("F00" display)

2.

<Temperature control>

Setting range : -18℃~-40℃
Display range : -50℃~+50℃
Setting method : Press SET key and set the required value with ⏫ key and ▶▶ Key. Press SET key again to memorize the set value, And then return to PV display.
Out of setting range : Change to out of setting range value and press SET key for 1 second continuously.

<Alarm>

High temperature alarm :

When the internal temperature is higher than SV (-5℃~+15℃), alarm lamp and digital display is blinking. After 15min.later, buzzer will sound and remote alarm output will turn ON. (initial value: +10℃)

Low temperature alarm :

When the internal temperature is lower than SV(-5℃~-15℃), alarm lamp and digital display is blinking. After 15min.later, buzzer will sound and remote alarm output will turn ON. (initial value: -10℃)

Setting method :

Keep pressing ⏫ key over 5 seconds to enter function mode ("F00").
Then press the key to count up value. The value "F01" means to enter high temperature alarm value, "F02" means to enter low temperature alarm value.
Set either "F01" or "F02" then press SET key and turn to alarm temperature setting mode to set required value with ⏫ key and ⏩ key. Press SET key again and memorize set value.

Out of setting range :

When press SET key with changed to out of setting range value, buzzer sounds for 1second continuously and keep the setting status.

3. Defrosting

In PV display keep pressing DEF key over 5 seconds, it will be start defrosting.
The function is forced to turn compressor OFF. Press again DEF key to quit defrosting.
(Manual start and end)

4. Self diagnosis function

E01 : Temperature sensor is open circuit
E02 : Temperature sensor is short circuit
E03 : Compressor protect sensor is open circuit (MDF-436 only)
E04 : Compressor protect sensor is short circuit (MDF-436 only)
E09 : Forget to turn battery switch ON or battery no-charged (available during alarm test)
E10 : Compressor temperature is abnormal (MDF-436 only)

When temperature sensor is open circuit, display shows alternately E01 with -50℃.
When temperature sensor is short circuit, display shows alternately E02 with +50℃.
Self diagnosis of open circuit is done when it is lower than -60℃ for temperature exchange.
Self diagnosis of short circuit is done when it is higher than +60℃ for temperature exchange.
E09 is functioned only during ALARM TEST is performed.
In E10 is displayed, it regards as abnormal when condenser temperature is higher than 100℃, and as normal when lower than 65℃.
When it is lower than 65℃, E10 is regarded as normal.

When numbers of error happened simultaneously, error code of smallest digit will be displayed. However, E09 is displayed during ALARM TEST.

5. Key lock function

In PV display、Keep pushing ▶▶ key over 5 seconds to enter key lock mode displaying with "L0".

Push ▲ key to 1 ·····key rock ON

0 ·····key rock OFF

Then press SET key to memorize set value then return to PV display.

Note) With key lock ON to enter SET mode, but unable to change value.
With key lock ON to perform Function and ALARM TEST, while unable to perform DEF.

6. Power failure alarm

When power failure is occurred, power failure alarm will be turned on by battery switch inside units. During power failure alarm, alarm lamp is blinking, digit display turns off, buzzer sounds intermittently and remote alarm output turns ON.
Press BZ key to turn power failure alarm buzzer OFF.
Press BZ key to check PV, PV will be displayed for 5 seconds.
During power failure alarm, any but BZ key is available.

7. Alarm test

The function is to check performance for alarm lamp, buzzer and remote alarm.
In PV display, press ALARM TEST key to blink alarm lamp, to sound buzzer intermittently, to turn remote alarm on. (Without time lag)
Digital display will be turned off.
During alarm test, any but ALARM TEST key is available.
During alarm test, turn buttery switch OFF to display error code E09.
During alarm test, error code E09 takes priority over other error codes to display.
Notes:
*Above power failure alarm is performed with buttery switch ON and charged. With buttery switch OFF or discharged, only remote alarm is performed.
*Power failure alarm will be performed for 12 hours continuously with buttery full charged. Running freezer for 2days to charge buttery fully.

8. Auto return function

During setting mode, key lock mode and function mode with any key not pressed for 90 seconds, value will not be memorized to return to PV mode automatically.
Note: In F09 and F10 (line test mode) displayed, Auto return function will not be performed.

9. Compressor time lag

During cycle time, turn compressor ON to be forced turn OFF after 2 minutes.

10. Function mode

Functions are as follow.

F00 : To return to PV display (use in case entered by mistake)
F01 : To change temperature of high temperature alarm
F02 : To change temperature of low temperature alarm
F03 : Not functioned
F04 : Not functioned
F05 : To set compressor time lag
F06 : To input service code (384)
F07 : To set temperature zero adjustment (±9.9℃,differential value input)
F08 : Not functioned
F09 : Line test mode (Maximum cooling test)
F10 : Line test mode (program)
F11 : No functioned
F12 : To display temperature of temperature control sensor (per 0.1℃)
F13 : To display temperature of compressor protect sensor (per 1℃)
F14 : Not functioned
F15 : Not functioned
F16 : Not functioned
F17 : Family type code 001 : MDF-136、236 002 : MDF-436
F18 : Not functioned
F19 : Not functioned
F20 : Not functioned
F21 : To set communication ID(000～255)
F22 : To set communication mode
F25 : To set alarm reset time (applied for each models from S/N 020001 and after)

Setting method : In PV display, keep ⏫ key pressing over 5 seconds to enter function mode and will be displayed "F00". Press ⏫ key to input required function code then put SET key.

F00 : It is not functioned. In F00 displayed, press SET key to return PV display.

F01 : To set value of high temperature performance in the range of SV +5℃～+15℃.
(initial value : +10℃)

F02 : To set value of low temperature performance in the range of SV -5℃～-15℃.
(initial value : -10℃)

F05 : To set compressor time lag
(performed only with main power supplied and microcomputer reset)
The function is to reduce numbers of units start-up at the same time that cause compressor's start-up failure or users' breakers blow out after power failure.
The range of time lag is 1～15 minutes. (On factory outgoing, initial value set at 1 minute) With F10 performed to memorize the initial value 1 minute.
Before F10 is performed, time lag set at 3 seconds. Therefore, the time lag is 3 seconds when PCB replacement is performed by service.

F06 : Put service code with ⏫ key and ⏩ key when F07 and following functions would be performed. Press SET key to memorize service code to enter function mode again to perform F07 or bigger figure functions.

In special case, F21, F22 and F25 changes communication parameter without input any service code. Service code: 384

Note) Above code is memorized unless input "000" again with "F06" displayed, or turn main power OFF.

F07 : To set 0 adjustment of temperature control sensor (setting range: -9.9℃～+9.9℃)

Setting method : In "F07" displayed, press SET key to display "00.0" (initial value).

Set temperature with ⏫ key and ⏩ key and press SET key again to memorize set value. Input by differential value.

Ex) With measured –28.5℃at 1/2H of chamber and -30℃at digital display shown, add +1.5(-28.5-(-30))to digital display (F07).

⏫ key enables to change only "0" and "-" in second digit and to change "0"～"9" in first digit and first decimal.

⏩ key enables to shift the second digit ⇔ the first digit ⇔ the decimal point⇔the second digit.

F09 : Line test mode

This function is for arrival test, and force to turn compressor ON in spite of any SV.

(No time lag)

With E10 performed, cause to force compressor stop. (E10 takes advantage)

Setting method : In "F09" is displayed (digit is blinking), press SET key to display alternately "F09" with PV. (90seconds auto return will be not functioned)

Cancellation : Press SET key to cancel this mode to return to PV.

Note) During F09 is performed, high-low temperature alarm is not available.

F10 : Line test mode

The function is to set SV at -30℃ after 3.5hrs running at SV -45℃.

Setting method : In "F10" is displayed with digit blinking, press SET key to display alternately "F10" with SV. (90 seconds auto return will be not functioned)

Cancellation : Automatically finish this mode after 3.5hours passed.
Press SET key to quit to return to PV.

Note) Automatically SV is forced to set at -30℃, in spite of any SV before F10 performed. Set compressor time lag for 1 minute. When main power turns off or power failure occurs during this mode, the SV will be not memorized.

F12 : Temperature of temperature sensor is indicated as per 0.1℃.

From second digit to first decimal point is shown in display.

It is not shown "-" in display when temperature is lower than -20℃.

(Ex. Actual temperature -35℃ → Display shows 35.0℃)

When temperature is within the range of -19.9℃～-0.1℃, "-" is displayed.

F13 :Temperature of compressor protect sensor(for MDF-436) is indicated as per 1℃.
Range: -50～+110℃

F17 :Family type code setting
001 :MDF-136、MDF-236
002 :MDF-436
Method : In "F17" displayed, press SET key to show initial value "001".
Set value with ⏫ key and press SET key again to memorize value.
Followings are initial setting value.
Temperature setting value of internal chamber : -30℃
Key lock mode : 0 (OFF)
High temperature alarm : SV+10℃
Low temperature alarm : SV-10℃
0 adjustment : +0℃ (for temperature sensor)
communication ID : 000
communication mode : 000
Set family type code as 002(for MDF-436) to activate compressor protect mode (which forced compressor to stop).

F21 : To set serial communication ID.
Input range: 000～255 (Communication is OFF in 000)

F22 : To set serial communication mode.
Control mode (3rd digit) 0 : Local (initial value)
1 : Remote
Baud rate (2nd digit) 0 : 2400bps (initial value)
1 : 4800bps
2 : 9600bps
1st digit is not used.
Note) Set control mode as "remote" unable to change SV and defrosting.

F25 : To set alarm recovery time.
During alarm is performed and buzzer sounds, press BUZZER key to stop buzzer sound and remote alarm perform. After alarm recovery time is passed and alarm still remains, buzzer will sound and remote alarm will perform again.
Setting method: In "F25" displayed, press SET key to show current recovery setting time with second digit brinks. Press ⏫ key to turn large number in second digit. Press SET key to memorize recovery time then return to PV display.
*It is available to set recovery time as 10min. 20min. 30min. 40min. 50min. 60min.
With set as 000, alarm recovery is not performed.

11. Diffrential (COMP ON/OFF point for program)

COMP ON : higher than SV+0.0℃

COMP OFF: lower than SV-0.6℃

12. Offset value

The function is to correct differential value between temperature of temperature sensor and internal 1/2H. Temperature indicated by temperature sensor is -2.0℃ as offset value.

13. Remote alarm

During normal operation ... ... Remote alarm contact is OPEN

During alarm or power failure ... ... Remote alarm contact is CLOSE

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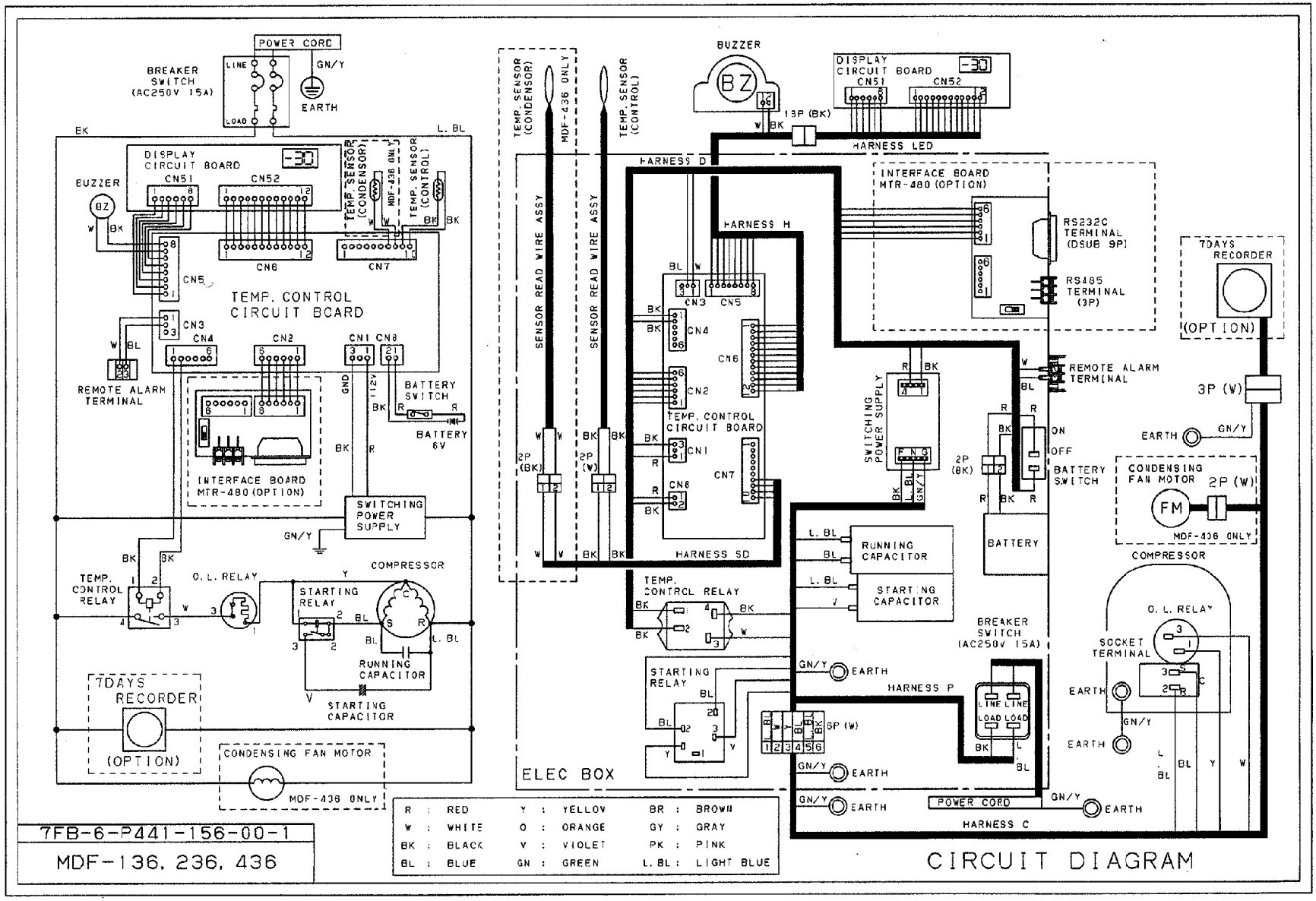
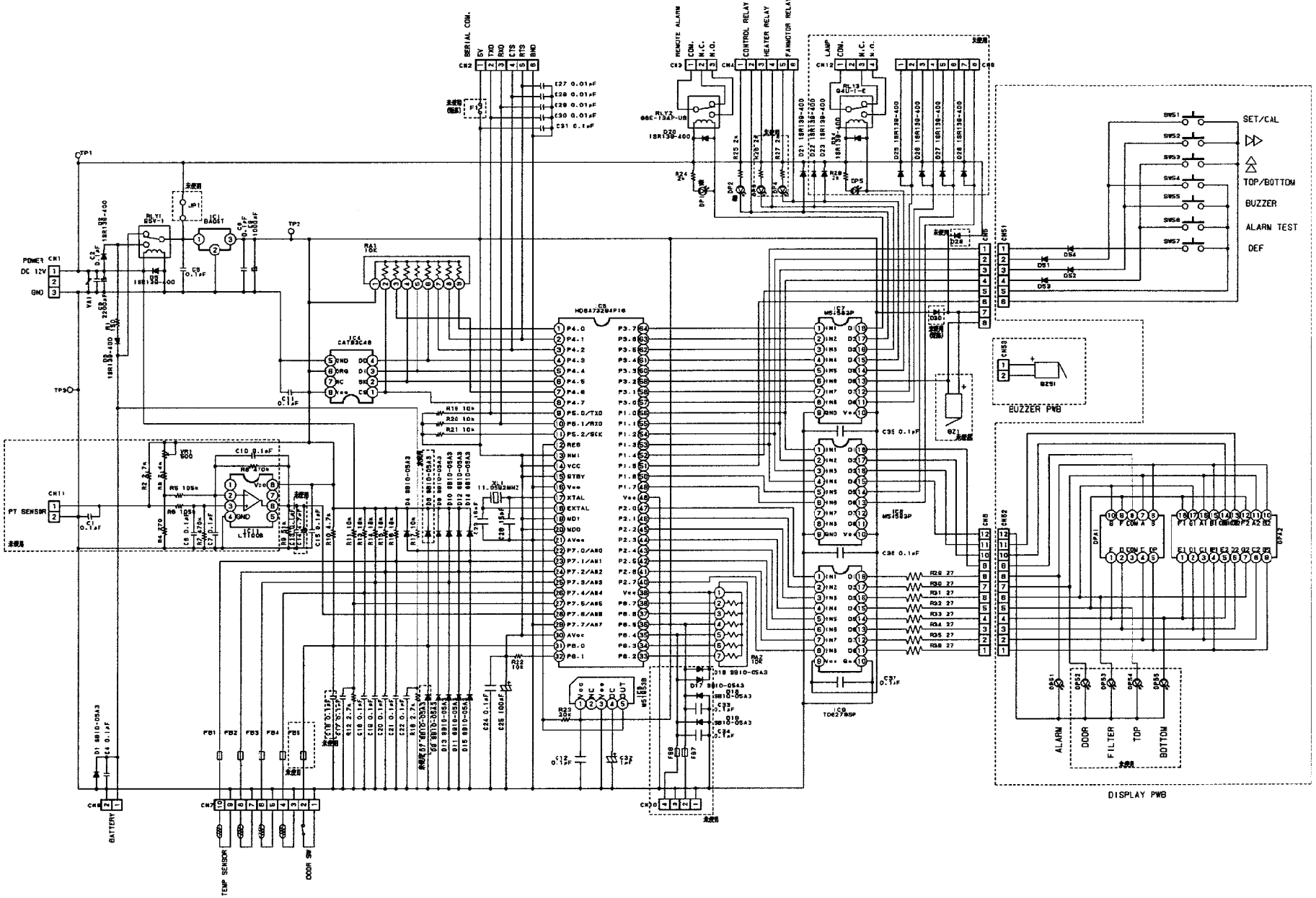
Wiring diagram



Circuit diagram

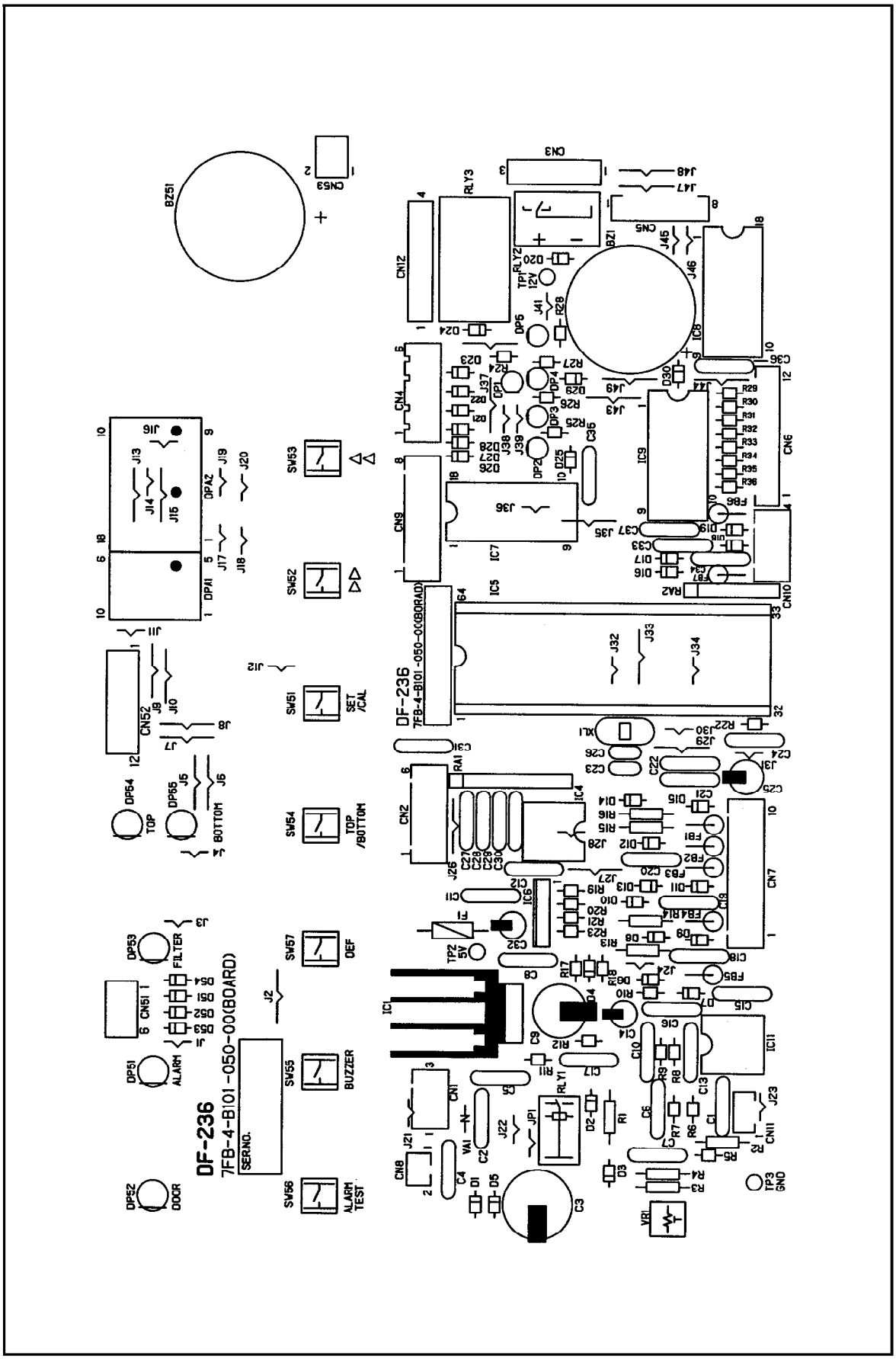


Connection on PCB

The following shows connections of connector (CN) on control PCB.

Connector	Connects to	Use
CN1	Battery #1: +12VDC #2: GND	To supply the power to PCB.
CN2	Not used	
CN3	Remote alarm terminal #1:Com #2:N.C.(when the power is not supplied) #3:N.O.(when the power is not supplied)	Remote alarm contact output ・With no alarm occurred and power supplied, contact between #1—#2 is open. ・#1 & #2 is connected to remote alarm contact.
CN4	Heater relay coil #1:+12V (relay is ON) #2:GND #3 - #6: not used	ON/OFF for heater relay.
CN5	Display PCB: CN51	To connect with each switch.
CN6	Display PCB: CN52	To connect with each LED.
CN7	Sensor #1 - #6: not used #7 - #8: compressor protect sensor #9 - #10: heater sensor	Compressor protect sensor is used for MDF-436 only.
CN8	Battery	To connect with power failure alarm buttery.

Components on PCB



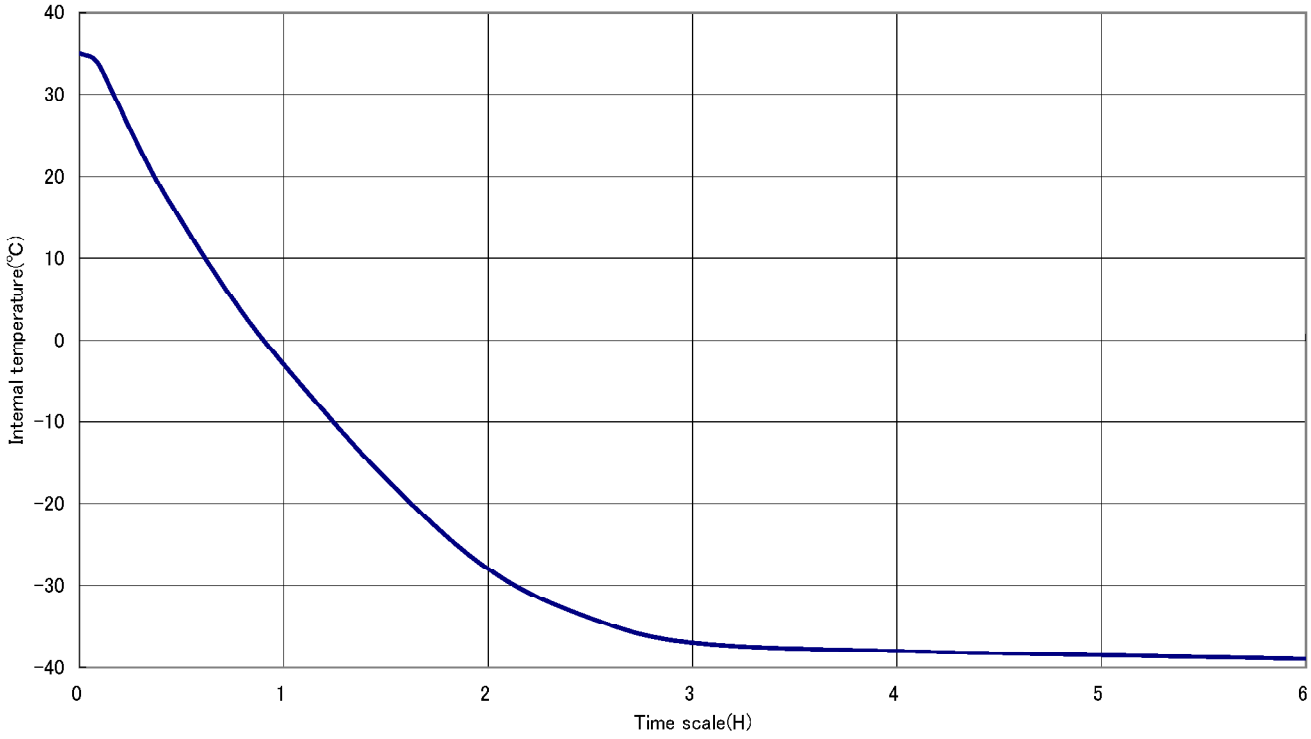
Test data

1. PULL DOWN SPEED
2. PULL UP SPEED
3. PULL DOWN PRESSURE
4. POWER CONSUMPTION AND CURRENT
5. TEMPERATURE UNIFORMITY AND FLUCTUATION TEST DATA

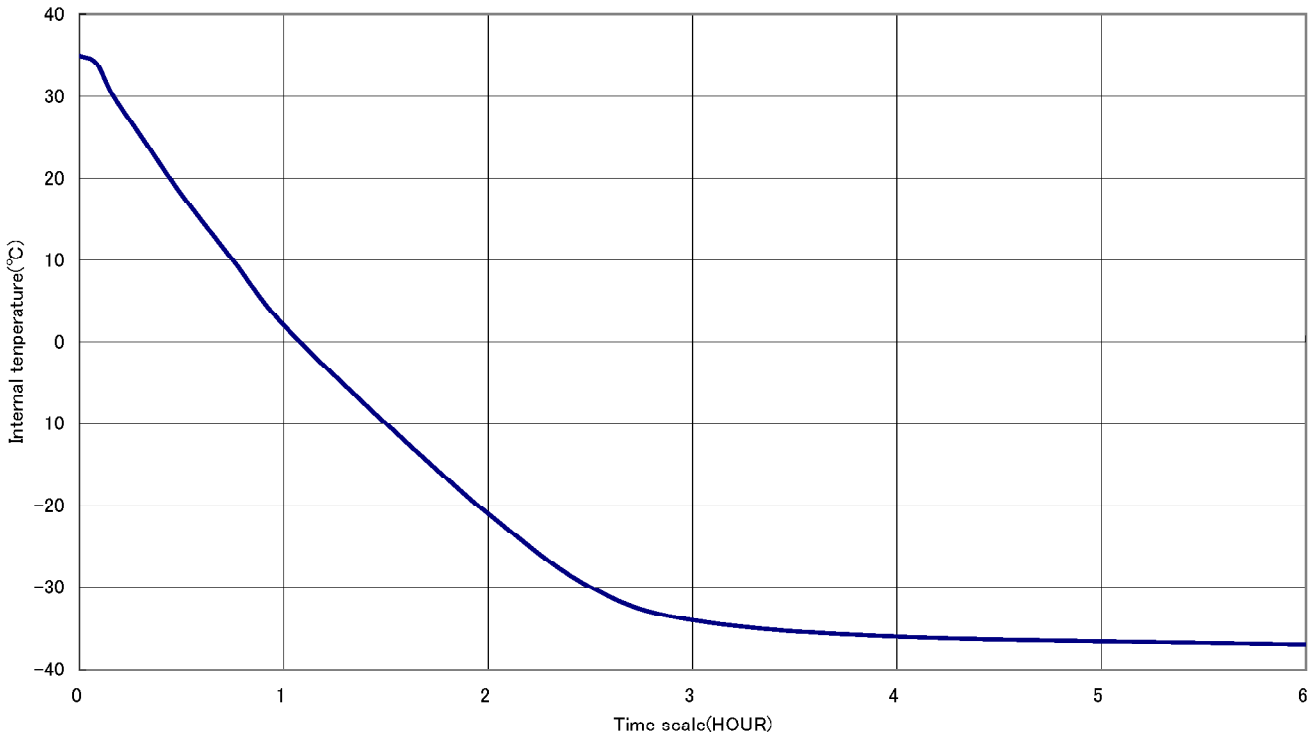
Note: These test data are only reference.

1. Pull down speed

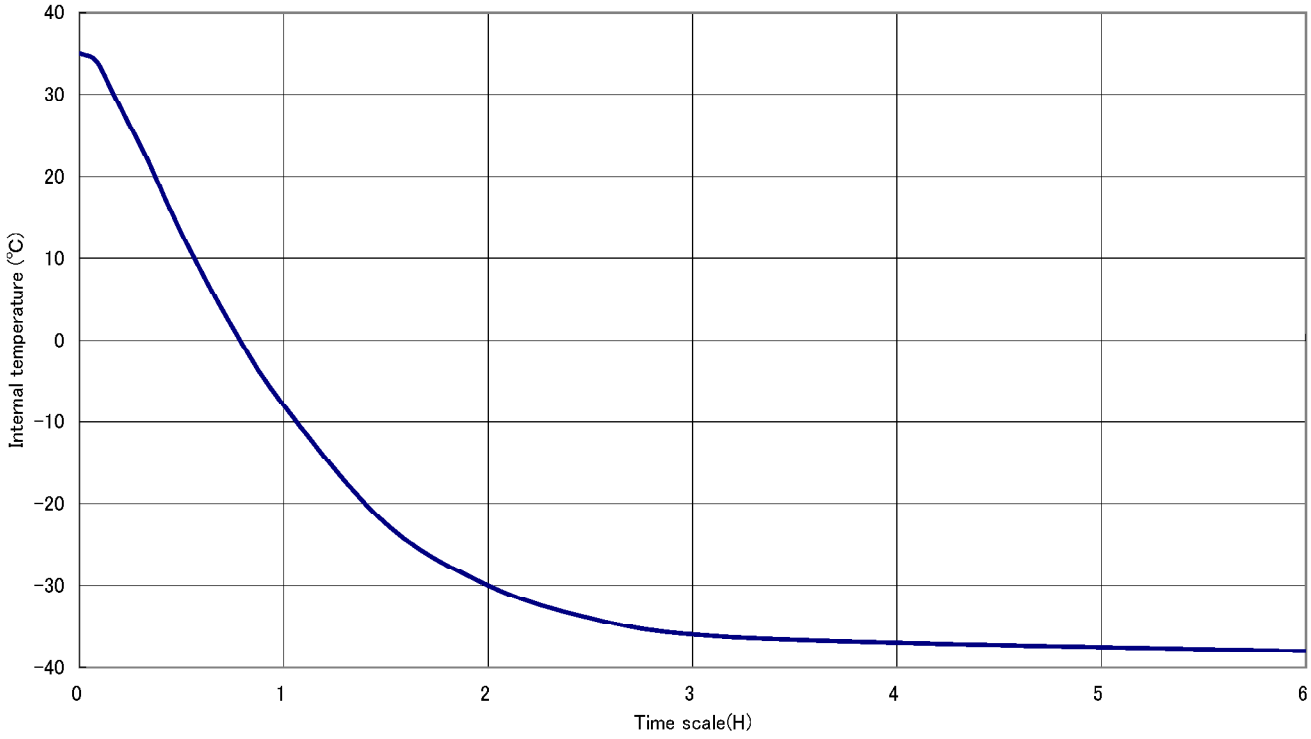
MDF-136 PULL DOWN 1／2H AIR (AT35℃ 50Hz)



MDF-236 PULL DOWN 1／2H AIR (AT35℃ 50Hz)

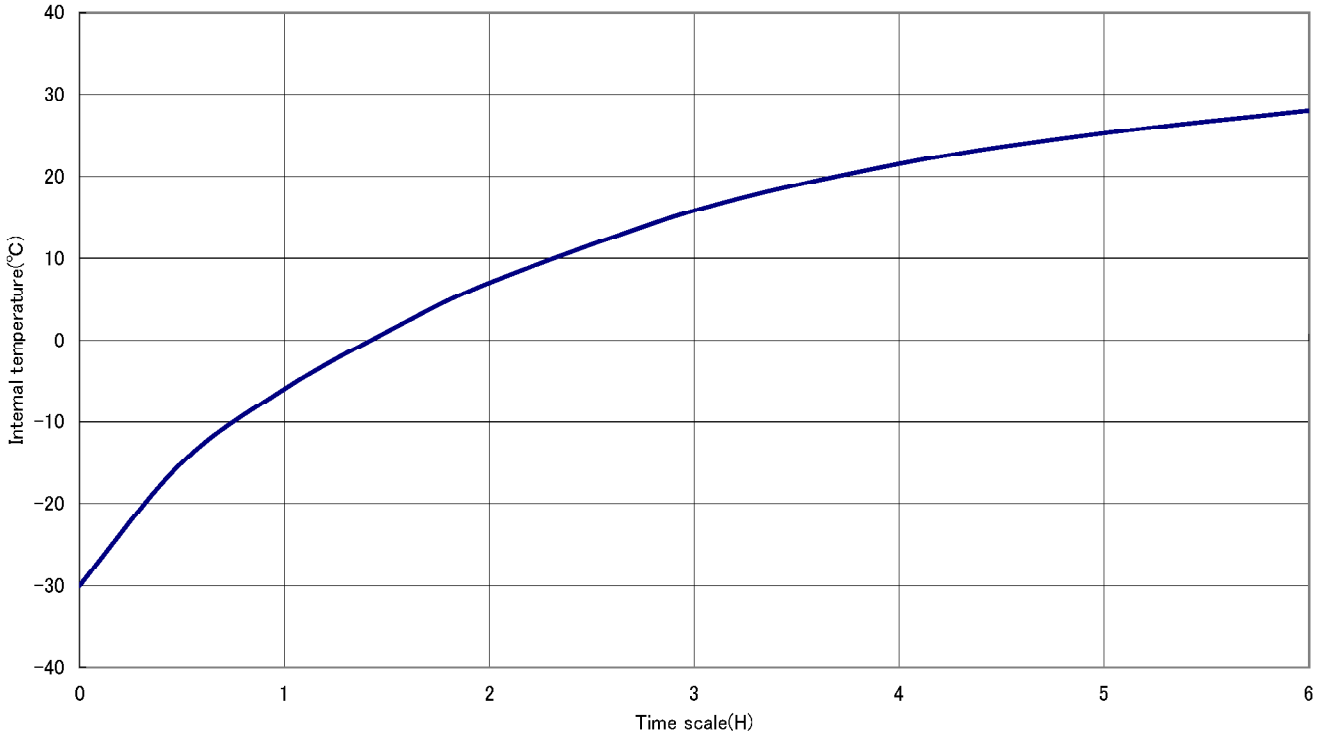


MDF-436 PULL DOWN 1／2H AIR (AT35℃ 50Hz)

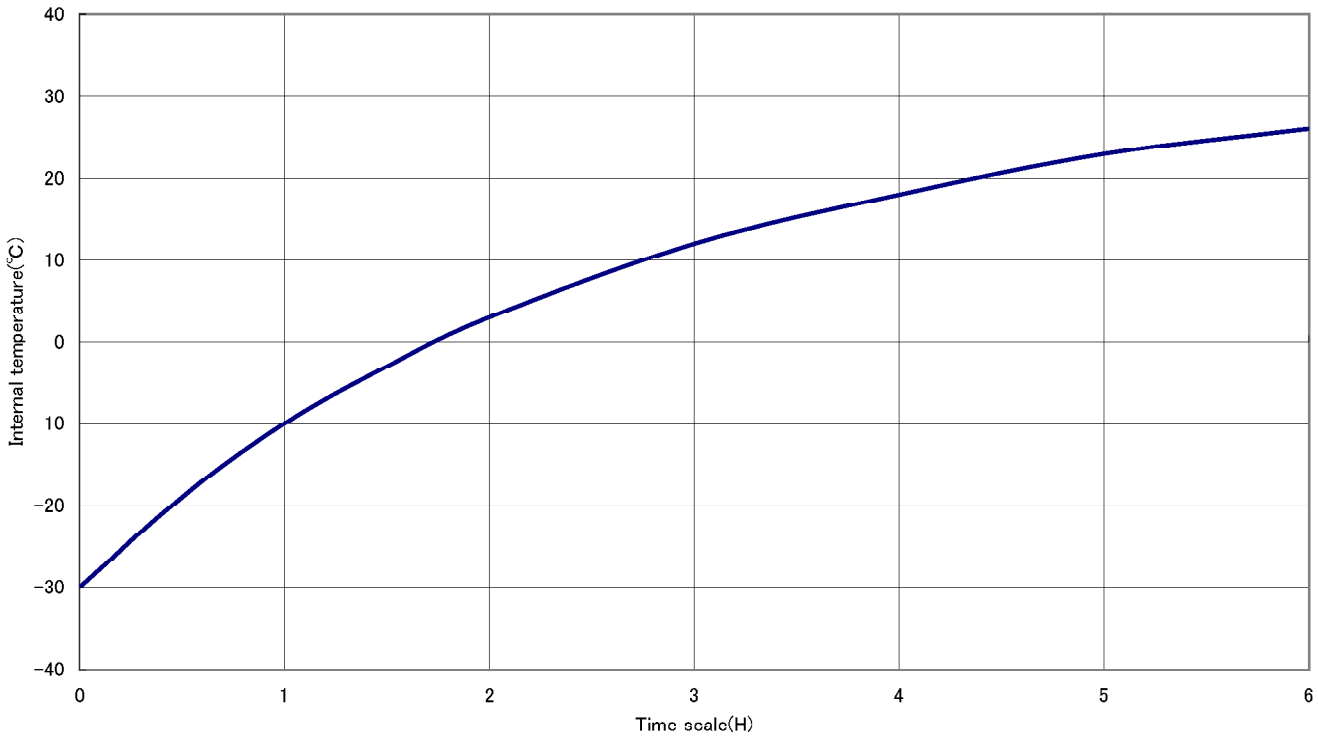


2. Pull up speed

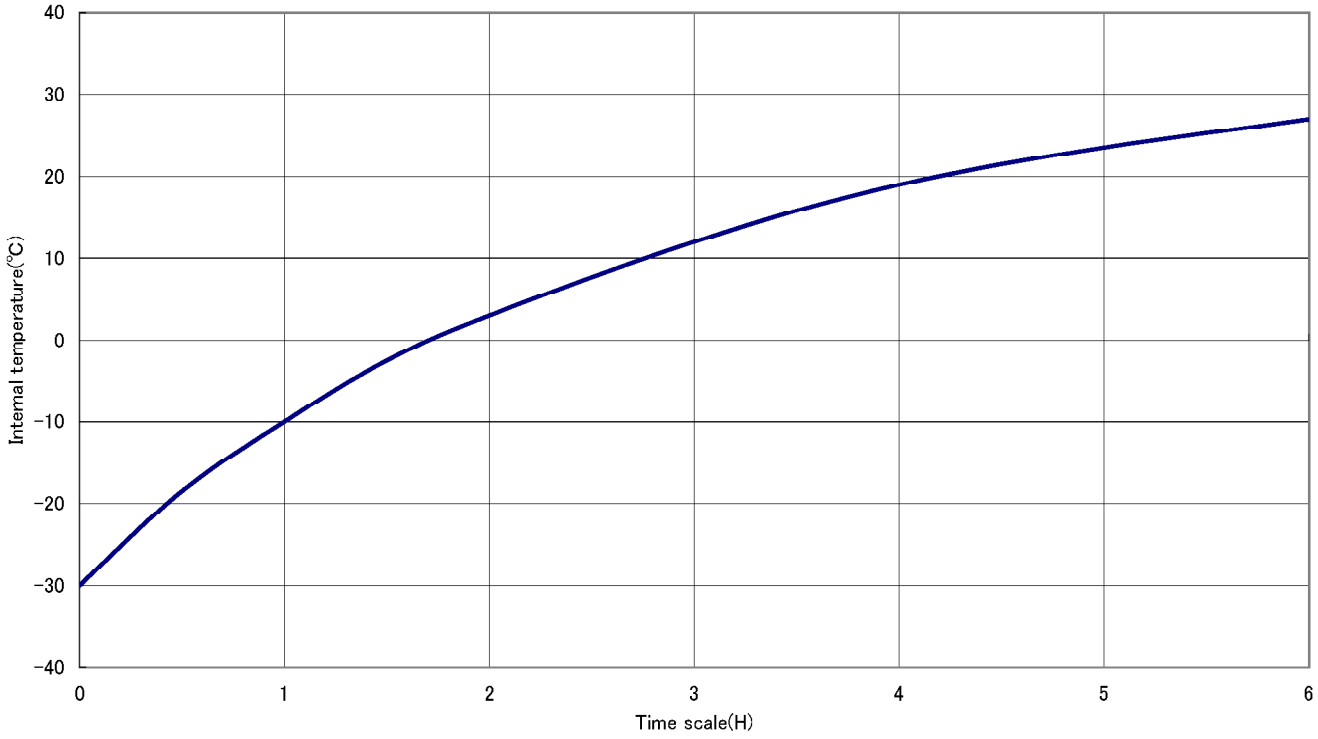
MDF-136 PULL UP 1／2H AIR (AT35℃)



MDF-236 PULL UP 1／2H AIR (AT35℃)

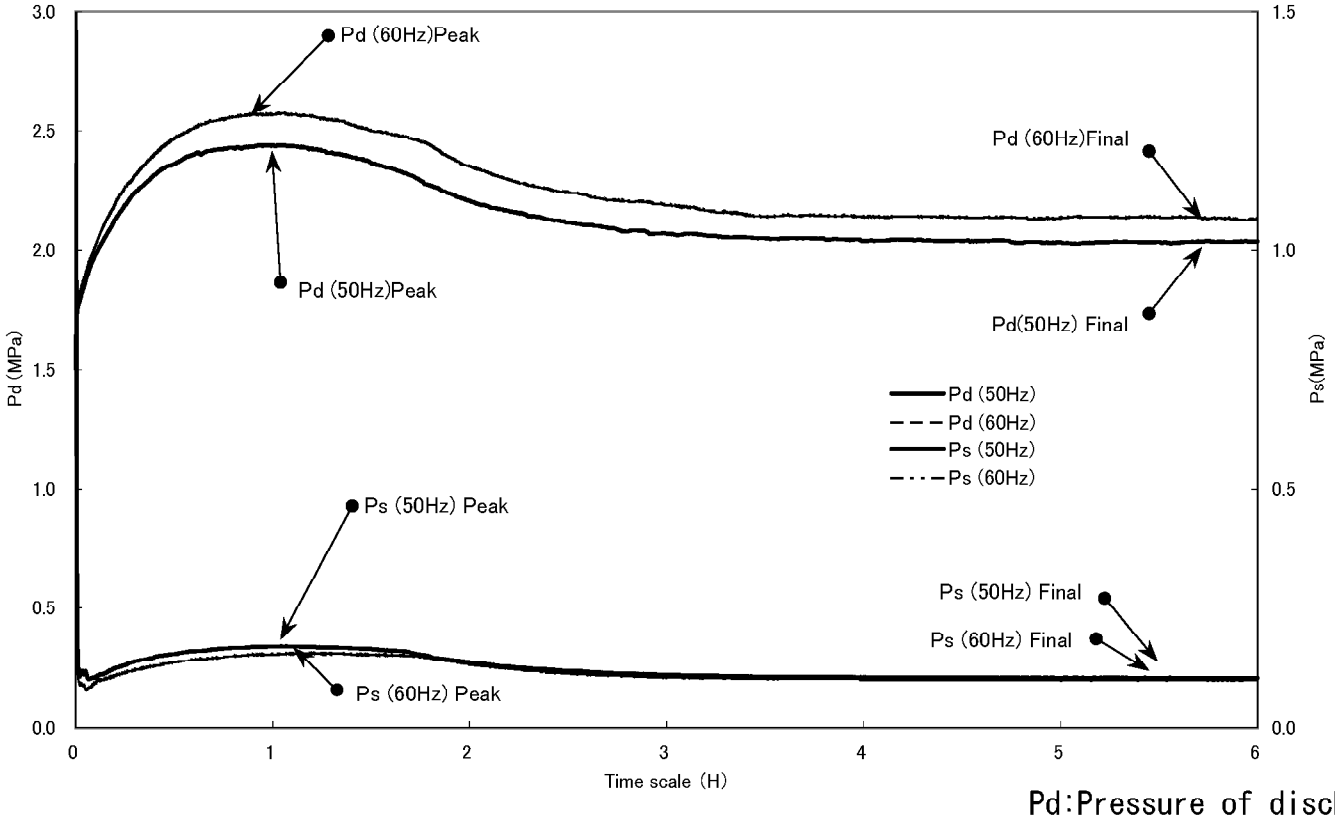


MDF-436 PULL UP 1／2H AIR (AT35℃)



3. Pull down pressure

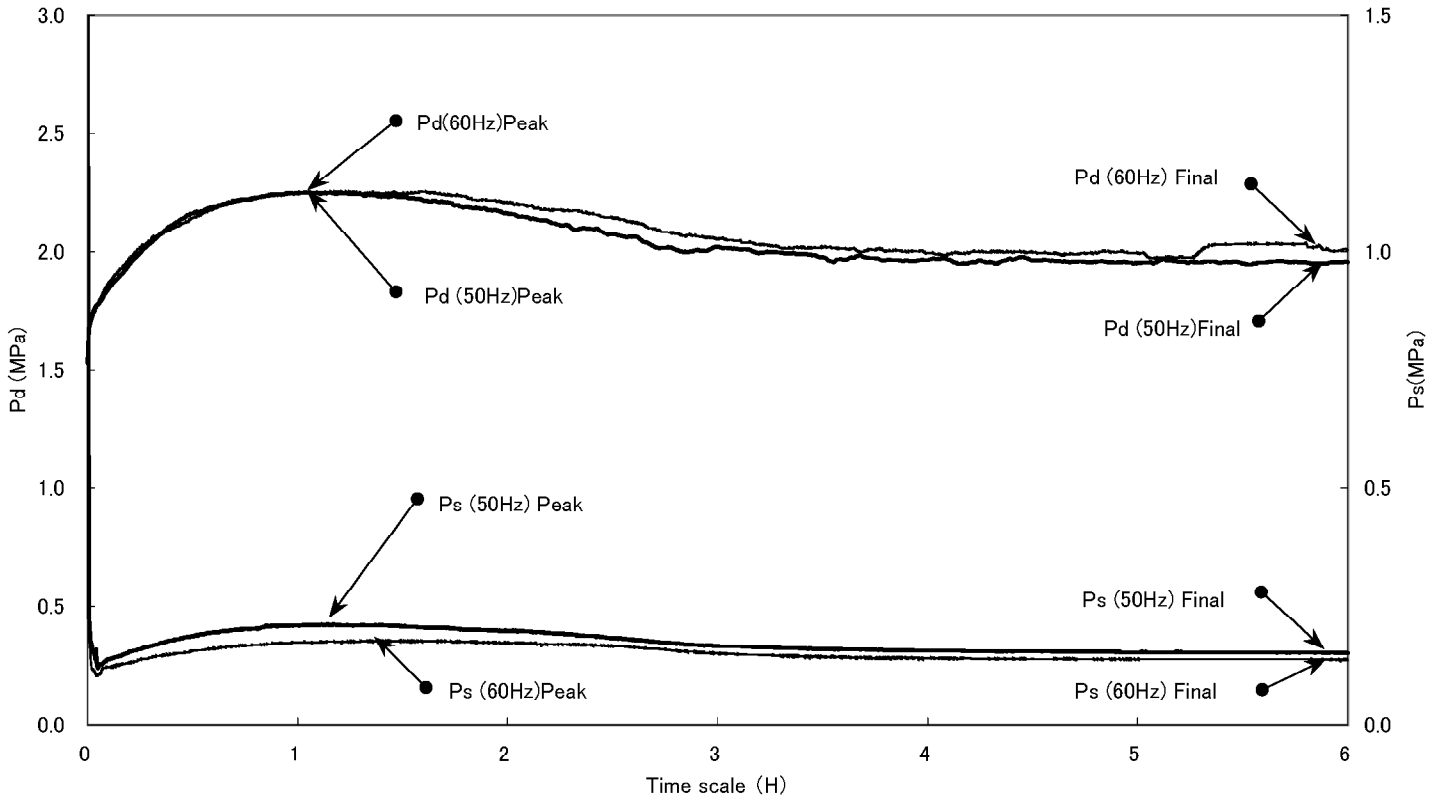
MDF－136 Pull down pressure （AT 35℃）



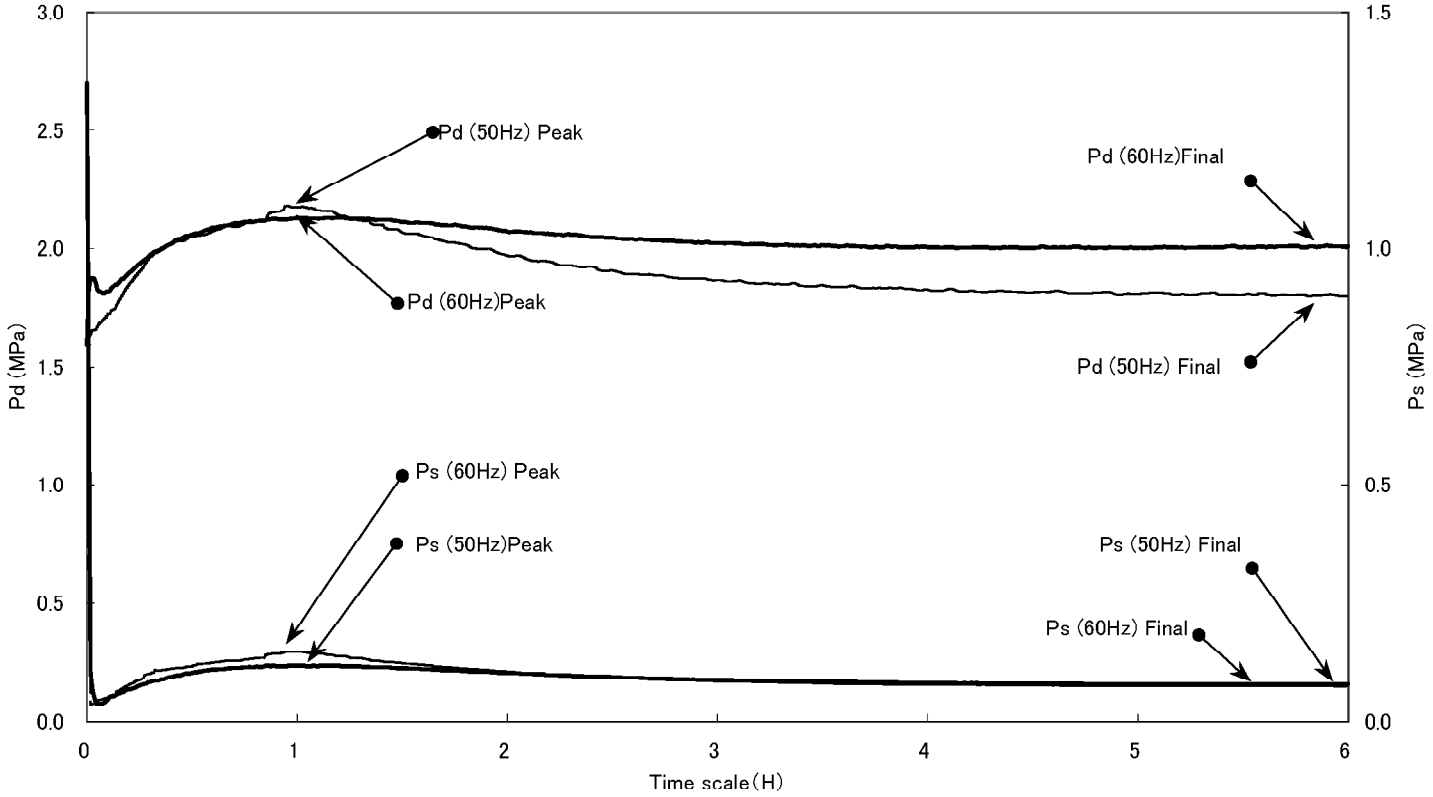
Pd:Pressure of discharge

Ps:Pressure of suction

MDF－236 Pull down pressure(AT 35℃)



MDF－436 Pull down pressure(AT 35℃)



4.Power consumption and curreent

Maximum power consumption and current
(Ambient temperature : 35℃)

MDF-136

Mains supply		peak	peak
V	Hz	(W)	(A)
115	60	210	1.9
220	50	170	0.9
220	60	185	0.9
230	50	175	1.0
240	50	180	1.0

MDF-236

Mains supply		peak	peak
V	Hz	(W)	(A)
115	60	180	1.6
220	50	170	0.9
220	60	195	0.9
230	50	205	1.0
240	50	190	1.0

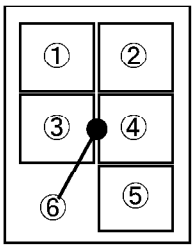
MDF-436

Mains supply		peak	peak
V	Hz	(W)	(A)
115	60	340	3
220	50	310	1.7
220	60	320	1.6
230	50	280	1.6
240	50	320	1.8

5.Temperature uniformity and fluctuation test data

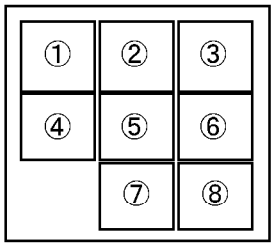
[Measureing condition]
Ambient temperature : 35℃
No load
Measureing method : Air temp.
Measureing points : As below

MDF-136



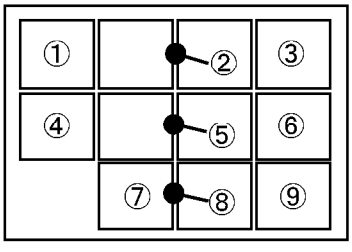
Measureing points		Set temperature (℃)			
		-20	-25	-30	-35
①		-19.0	-24.0	-29.3	-35.4
②		-19.1	-24.1	-29.5	-35.3
③		-20.0	-24.9	-30.3	-37.8
④		-19.8	-24.7	-30.2	-37.8
⑤		-19.9	-24.7	-30.2	-37.9
⑥		-19.6	-24.6	-30.0	-37.8
Uniformity	Max.	-19.0	-24.0	-29.3	-35.3
	Min.	-20.0	-24.9	-30.3	-37.9
	Range	1.0	0.9	0.9	2.7
Fluctuation of measuring point ⑥	Max.	-18.8	-24.0	-29.5	-36.1
	Min.	-20.4	-25.3	-30.5	-39.5
	Range	1.6	1.3	1.0	3.4

MDF-236



Measureing points		Set temperature (℃)			
		-20	-25	-30	-35
①		-18.0	-22.7	-28.0	-34.7
②		-18.5	-23.3	-28.7	-35.3
③		-18.5	-23.2	-28.6	-35.2
④		-19.5	-24.1	-29.5	-36.6
⑤		-19.1	-23.5	-29.0	-36.0
⑥		-19.2	-23.6	-29.1	-36.1
⑦		-19.9	-24.2	-29.5	-37.0
⑧		-19.4	-23.8	-29.4	-36.8
Uniformity	Max.	-18.0	-22.7	-28.0	-34.7
	Min.	-19.9	-24.2	-29.5	-37.0
	Range	1.8	1.5	1.5	2.2
Fluctuation of measuring point ⑤	Max.	-18.0	-22.9	-28.2	-34.3
	Min.	-20.2	-24.4	-29.7	-37.9
	Range	2.2	1.5	1.5	3.6

MDF-436



Measureing points		Set temperature (℃)			
		-20	-25	-30	-35
①		-21.3	-25.2	-29.4	-35.2
②		-21.3	-25.1	-29.5	-34.7
③		-21.4	-25.3	-29.5	-34.7
④		-21.6	-25.2	-30.0	-36.8
⑤		-22.5	-26.0	-30.0	-37.1
⑥		-22.7	-26.2	-30.0	-37.1
⑦		-22.7	-26.1	-29.6	-37.8
⑧		-22.8	-26.2	-29.7	-37.8
⑨		-23.0	-26.3	-29.9	-37.7
Uniformity	Max.	-21.3	-25.1	-29.4	-34.7
	Min.	-23.0	-26.3	-30.0	-37.8
	Range	1.7	1.2	0.7	3.1
Fluctuation of measuring point ⑤	Max.	-21.7	-25.5	-29.7	-36.2
	Min.	-23.2	-26.5	-30.3	-37.8
	Range	1.5	1.0	0.6	1.6

note) These data are reference only

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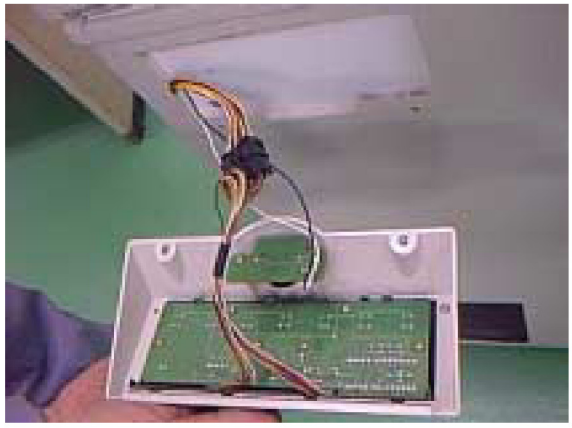
Parts layout

Door hinge cover

Door hinge cover removed

Control panel

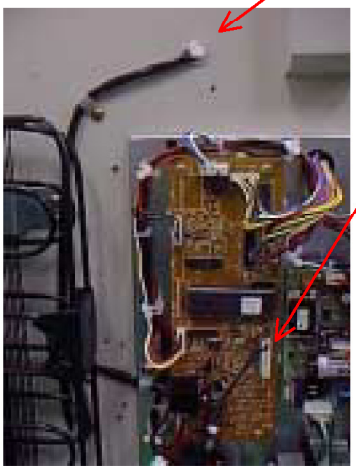
Control panel removed



Temperature control sensor cover

Temperature control sensor (Loaded)

Entrance of temperature control sensor on the back



Temperature control sensor connector insert

Bend temperature control sensor to attach load with it.

Recorder connection terminal

Recorder cover removed

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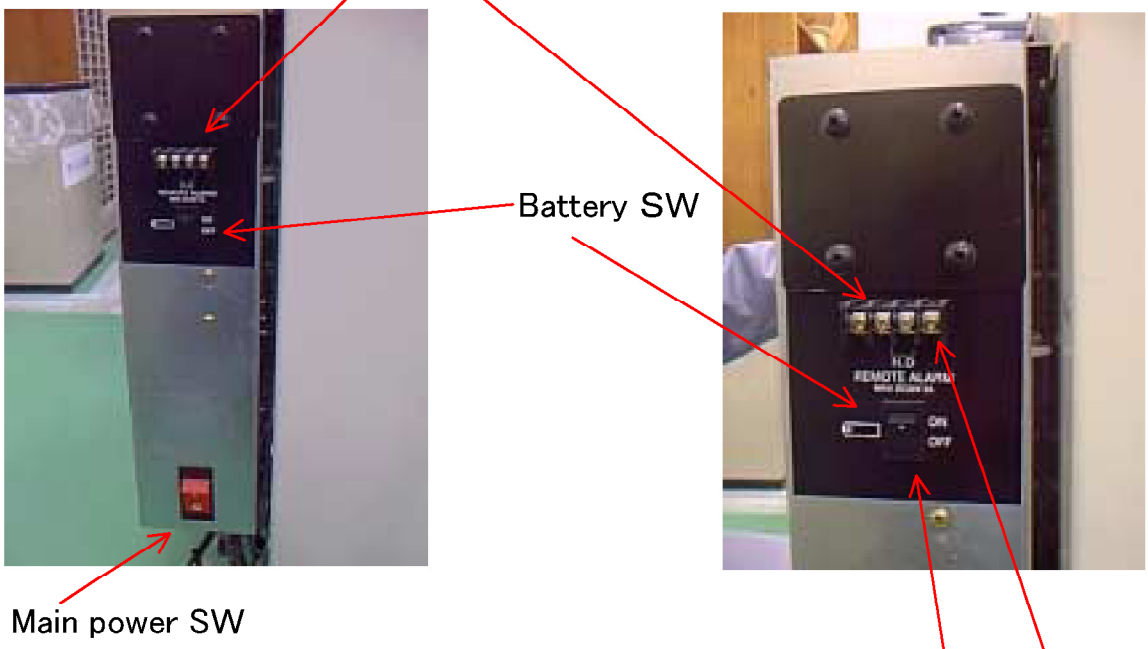
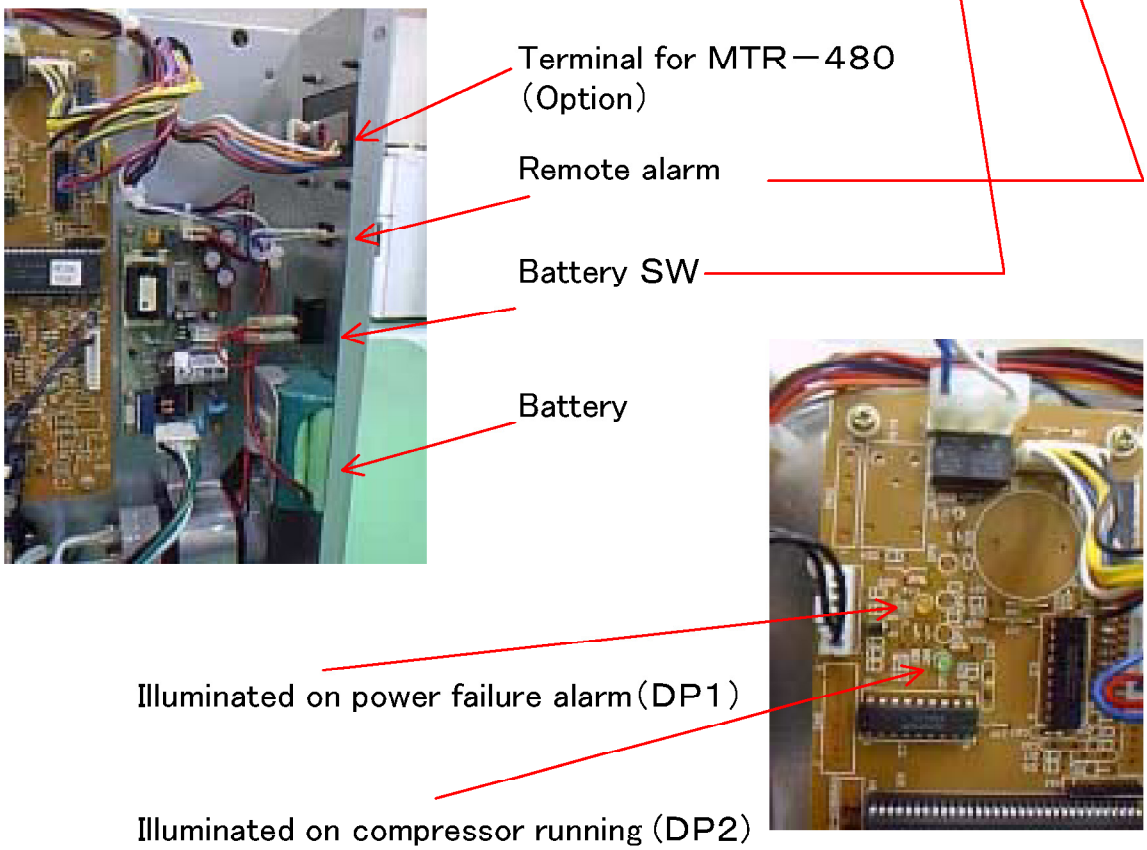

Remote alarm
Battery SW
Main power SW


Terminal for MTR－480
(Option)
Remote alarm
Battery SW
Battery
Illuminated on power failure alarm(DP1)
Illuminated on compressor running (DP2)